IDRC EXPERIENCES IN THE SUPPORT OF ANIMAL PRODUCTION SYSTEMS RESEARCH IN DEVELOPING COUNTRIES

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INTRODUCTION

The International Development Research Centre (IDRC) is an institution created by the Canadian Parliament to promote and support applied research in developing countries. Since its creation, IDRC has chosen to support research for the benefit of small farmers, taking into consideration their important contribution to national economies, their needs and aspirations, and the fact that they have been neglected by many research and development efforts. In pursuing this, IDRC has supported many projects in which holistic and participatory approaches have been followed. The reasons for this have been mentioned in the introductory remarks to the present workshop (Li Pun 1991).

The first of these projects (begun in the mid-1970s) were in cropping systems in Asia and were linked to the activities of the International Rice Research Institute (IRRI). These activities were later extended to other national programs in Asia, Latin America, and Africa. About the same time, IDRC supported a project in integrated rural development in Caqueza, Colombia. This also served to expand client-oriented activities in other parts of the world.

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In 1976 IDRC supported the first animal production systems project in Central America at the Tropical Agriculture Research and Training Center (CATIE). This was followed by a large number of projects in other Latin American countries, eventually leading to the formation of the Latin American Research Network for Animal Production Systems (RISPAL). The RISPAL network has operated informally with IDRC's support since 1981 and has been formally coordinated by the Inter-American Institute for Cooperation on Agriculture (IICA) since 1986. Animal production systems projects were also supported by IDRC in Africa starting in 1983; however, the networks supported by IDRC in that region have been commodity-oriented (pastures: PANESA; by-products: ARNAB)[5]. The focus of the Asian Cropping Systems Network was later expanded to include crop-livestock systems in 1984 and rice-fish systems in 1987.

Through the years, IDRC has been incorporating the lessons learned from previous projects, and the scope and coverage of these projects have been evolving. IDRC has established support to systems research as one of its top priorities, even while recognizing that most national agricultural research systems are organized along commodity lines. The role of networks has been instrumental (1) in creating a critical mass of researchers following the same objectives and methodologies, (2) as a forum for the exchange of experiences, and (3) as a source of training and mutual backup support. The purpose of this document is to present some of IDRC's experiences in animal production systems research, highlighting some of the results, the constraints, and the facilitating factors for this kind of activities; it will also discuss the outlook for systems research from IDRC's perspectives.

IDRC ACTIVITIES IN FARMING SYSTEMS RESEARCH

IDRC supports farming systems research and related activities, mostly through its former Agricultural, Food, and Nutrition Sciences Division. Other divisions such as Communications, Information Sciences, and Fellowship and Awards have also financed some activities. The support provided through the Crop Production Systems Program, Animal

[5] PANESA: Pasture Network for Eastern and Southern Africa, ARNAB: African Research Network for Agricultural By-products.

Production Systems Program, Forestry, and Agricultural Economics, has been mostly in specific research projects in cropping, animal production, or agroforestry systems. Also, the following networks are being financed by IDRC: RISPAL (The Latin American Network for Animal Production Systems), ARFSN (Asian Rice Farming Systems Network), RIMISP (International Network for Research Methodology in Production Systems), SRUPNA (Small Ruminant Production Systems Network). In addition, some other networks in which IDRC is involved are either following a systems perspective or have on-farm activities. That is the case of the CIAT-coordinated RIEPT (International Network for the Evaluation of Tropical Pastures) and the ILCA-coordinated AFRNET (African Feed Resources Network).

Through the years, support to systems-type research has been increasing in the different regions where IDRC operates. This trend has been more noticeable in the case of Latin America and Asia, where it is becoming the main priority in cropping, animal, and mixed systems (Figs. 1 and 2). In Africa, the evolution towards systems has been slower; however, emphasis on that type of research is increasing. The importance IDRC places on systems research is further illustrated by the fact that diagnosis, problem identification, and some kind of systems analysis is emphasized in many of the so-called commodity projects. Furthermore, lately IDRC has been promoting a whole-commodity system approach in some projects in order to link together the environment, production, processing, marketing, and utilization processes and to identify bottlenecks and opportunities for improvement.

Regional differences

Although there are some common elements in the types of institutional problems faced in different parts of the world, as well as in the characteristics of some ecosystems, IDRC has recognized the need for regionally differentiated programs to tackle the problems of the prevailing agricultural systems in Asia, Africa, and Latin America. Thus, in Asia, considering land constraints and the prevalence of mixed (crop-animal) systems, a higher priority has been given to those target systems as well as to the utilization of small ruminants in plantations in order to maximize output of animal products through the utilization of undergrowth. In Africa, given the importance of pastoral systems in the semiarid lands and the need to intensify land use in the more favorable highland areas of Eastern Africa, IDRC has chosen to concentrate efforts to address those systems.

In the dry/humid tropical areas of Latin America, considering that land is not a serious constraint, efforts have concentrated on the improvement of pasture-based dual-purpose cattle production systems. In the low humid tropics, due to the fragility of the ecosystems, IDRC has been supporting agroforestry and silvopastoral systems research. In the more unfavorable areas, such as the highlands of the Andean region, the emphasis has been on the improvement of mixed systems.

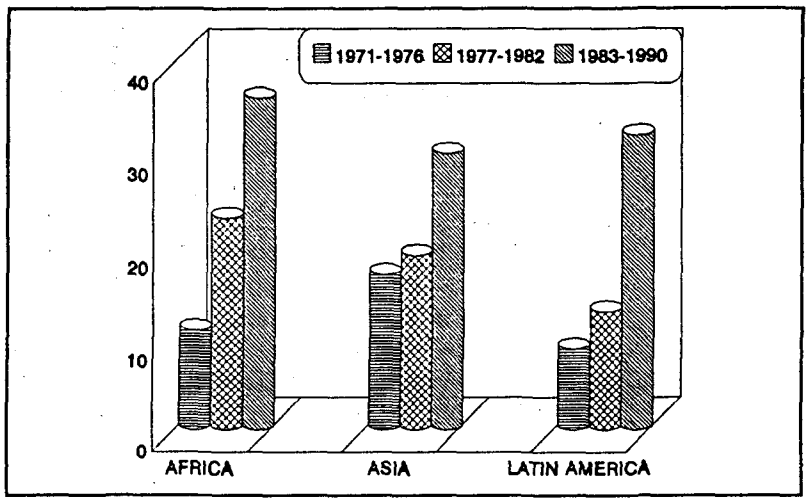

Fig. 1. IDRC's total investment in crop and animal production by region.

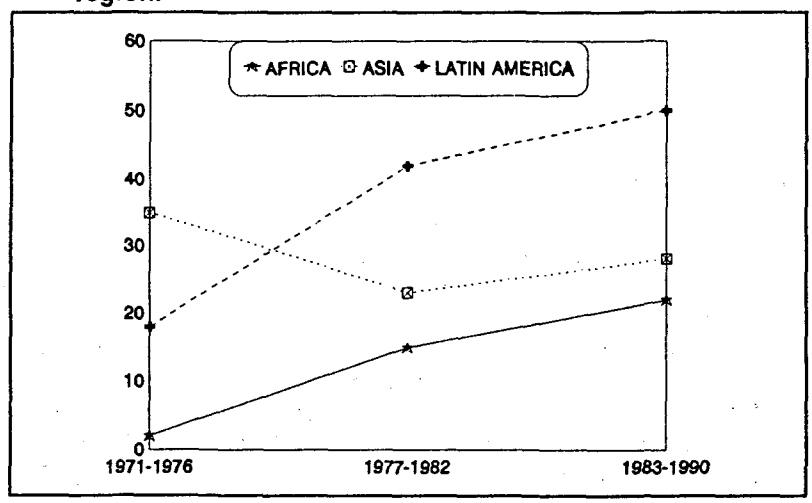

Fig. 2. Support to systems projects, according to regions 1971-1990

Strategies

Research approach. The main activity of IDRC is to support specific research projects addressing the problems of target systems in specific geographic areas. These target systems are usually selected on the basis of an analysis of the system's different hierarchies in order to judge the relative importance of the region and the specific target system within the country context (Fig. 3). For financial and administrative convenience, projects are supported in 3-year phases. However, generally they are financed for periods of more than 9 to 12 years, usually not exceeding CAD$100,000 per year.

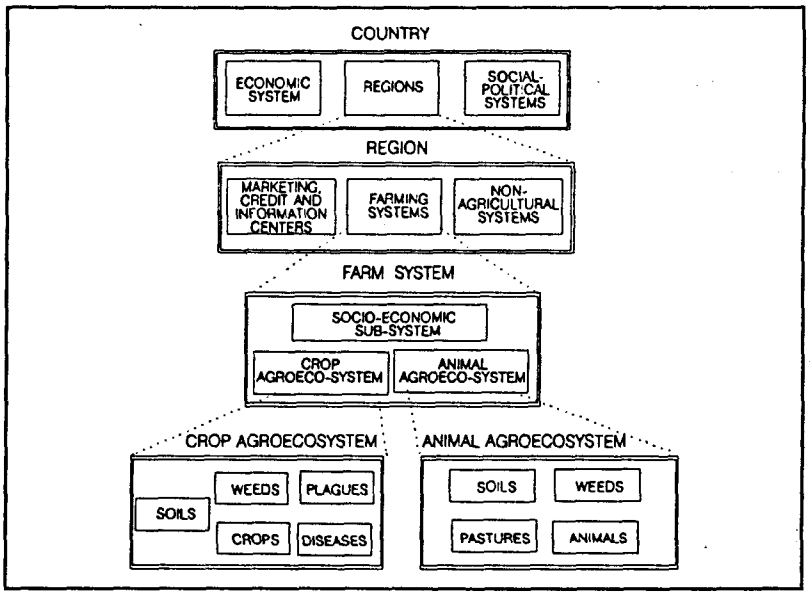

Fig. 3. A diagram illustrating systems hierarchy.

Adapted from Hart (1979).

Projects follow the general systems methodology, beginning with area selection and system characterization (rapid rural appraisal and static and dynamic surveys). Simultaneously, some exploratory trials are established. These trials lead to the design and on-farm testing of alternatives (Fig. 4). Training activities for researchers, extensionists, and farmers are established in all projects. Projects are directly administered by the

grantees, as IDRC believes strongly in the need to create managerial capacity within national institutions. Collaboration and backup by international or regional institutions is encouraged. Most projects participate in networks.

Agricultural systems research for the improvement of small farms is a relatively new field. Very few institutions offer organized training in systems. There are relatively few opportunities to present research results in the more organized scientific media (journals, forums, conferences). Systems researchers often have to work in isolation from the scientific community. One of the strategies followed by IDRC to fulfill some of the previously mentioned limitations is the organization of networks. These networks organize training activities and provide both technical backup to projects and a forum for the discussion and exchange of experiences; they also serve to promote research approaches and methodologies and help in their institutionalization.

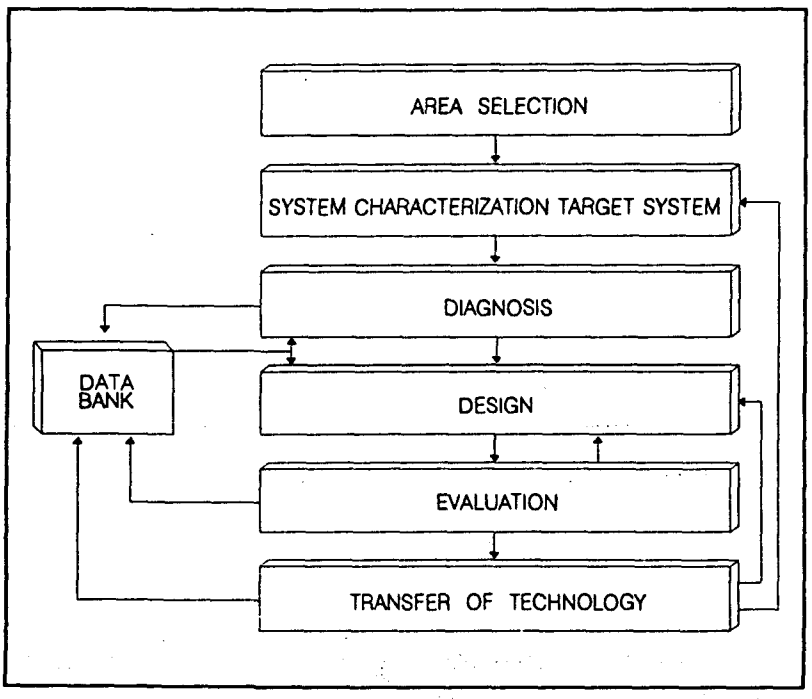

Fig. 4. Systems methodological phases.

Choice of institutions. Priority is given to the support of national institutions and universities. Support is also provided to regional and international organizations, especially for networking activities or for strategic research.

Technical manpower. Most projects are executed directly by local researchers who are staff members of the recipient institutions. Only occasionally, at the request of those institutions, IDRC assigns project advisors to fill specific needs. Otherwise, external support is provided through short-term consultants and monitoring by the Program Officers.

Monitoring and evaluation. Projects are monitored by Program Officers who are occasionally complemented by consultants and network coordinators. Formal evaluations are conducted in certain cases. However, most of the time informal evaluations take place, especially at the end of a three-year phase.

RESULTS

Bioeconomics

The results of projects supported by IDRC have been significant. They include the characterization of production systems, the development of methodologies, and the design of appropriate technologies and alternative systems. Some of the results have been presented in this meeting as well as in other ones. For the purpose of this presentation, the following are mentioned:

Design of alternative systems in Botswana. Livestock production in Botswana is an important activity. The country exports beef, but is a net importer of milk. In an effort to promote milk self-sufficiency as well as the agricultural sector in general, the government has assigned a high priority to the development of the dairy industry in the periurban areas. As part of this effort, the government is promoting dual-purpose (milk and beef) systems by crossing the native Tswana cattle with the Simmenthal. IDRC has been supporting the Department of Livestock Research in this type of activities since 1984. A diagnostic study was conducted in 1985 in order to identify farmers' constraints. The main limitations identified included inadequate feeding during the dry season and low productivity of the Tswana cattle. The project introduced the use of *Lablab purpureus* hay

and supplementation with sorghum bran to feed cattle during the dry season. The feeding package was tested on farms with both native and crossbred cattle. It was found that the milk yield of crossbred animals more than doubled that of the native cattle (Fig 5.). An economic analysis has not been done; however, farmers outside the project are showing interest in these technologies.

Dairy-beef production systems in Guatemala. This project is working on medium-scale farms in several areas of the country characterized by a high rainfall during the wet season (over 1,200 mm) and an extended dry season (6-8 months). Traditionally, farmers practice dual-purpose production systems based mainly on Brown Swiss x Zebu crossbreds; feeding is based on the use of jaragua grass *(Hyparrhenia rufa)* and African star grass *(Cynodon nlemfuensis)*. The project is being implemented by a group of institutions, including the Instituto de Ciencia y Tecnologia Agricola (ICTA), the Universidad de San Carlos, the Direccion General de Servicios Pecuarios (DIGESEPE), and the Inter-American Institute for Cooperation on Agriculture (IICA).

In addition to a complete characterization of the systems practiced, the project has generated various alternatives, especially for cattle feeding during the wet and dry seasons. Activities have included research on the introduction of improved species of grasses and legumes, pasture management, feed conservation for the dry season, cut-and-carry pastures for the dry season, the introduction of legume trees for dry season feeding, health diagnosis, and mineral and protein supplementation.

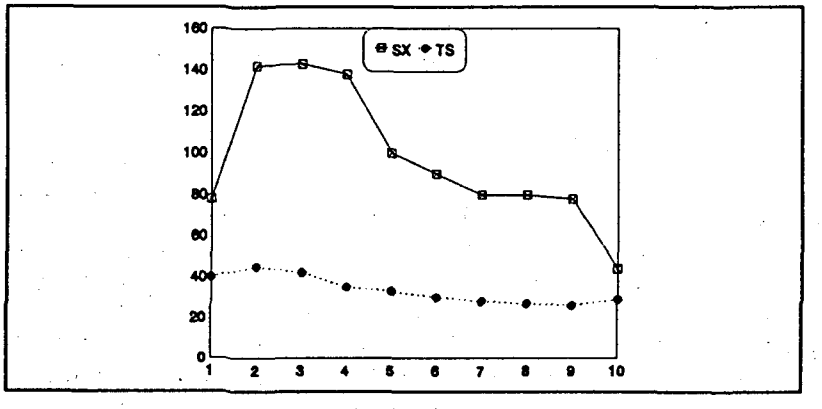

Fig. 5. Response of Simmenthal-Tswana (SX) and Tswana (TS) milking cows to an improved feeding system based on lablab hay and sorghum bran.

The results have been detailed in the projects' annual reports; for the purpose of this document, only the results of a technology adoption survey conducted by DIGESEPE are presented. The sample included 200 farmers. Eighty percent reported the use of cut-and-carry forages, mainly sugar cane; 30%, the use of silage; and 16.5%, the use of leucaena. These technologies have been promoted by the project (Table 1).

Table 1. Technology adoption in Guatemala

Technology	Percentage of farmers adopting it (n = 200)
Sugarcane	80
Corn/bean silage	30
Leucaena	16.5

Source: IICA (1991).

Amazonian production systems in Pucallpa, Peru. The Amazonian area of Peru constitutes the majority of the country's territory (approximately 60%). The region is still underpopulated; however, there is tremendous pressure for its utilization, since it constitutes the main agricultural frontier for the impoverished populations of the highlands and the coast. Migrants usually bring their animals and their own technologies. Land is being opened close to the highways and rivers to ensure transportation of inputs and products. Shifting cultivation is practiced. After the forest has been cut and burned, annual crops (corn, rice) are established taking advantage of the built-up soil fertility. After a few years, when fertility has been depleted, pastures are sown and animals are introduced.

Livestock production is the stabilizing force in the Amazonian system. For more than two decades the Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA) has been conducting research on tropical pastures and animal production at its station in Pucallpa. Given the relatively limited impact during the earlier years, IVITA approached IDRC for support in systems research. The cooperative project started in 1980. A diagnostic study was conducted to characterize the prevailing systems and identify their limitations. A strong component research program was carried out with emphasis on the search for low-input pastures that fit the system as well as on research in animal health, reproduction, management,

and economics. Seed production activities were established. Contacts with the Development Corporation of Ucayali were also established, leading to the implementation of a livestock development project.

IVITA's work has led to the development of some improved technologies, such as the use of *Brachiaria decumbens* pastures (Table 2). The project leader was supported for his Ph.D. degree in agricultural economics. As part of his dissertation, he conducted a survey of 128 farmers in Pucallpa in order to develop econometric models of technology adoption. It was found that there was wide adoption of improved pastures, especially *B. decumbens* and Kudzu *(Pueraria phaseoloides)* as shown in Table 3.

Table 2. Liveweight gain per animal in different pastures, Pucallpa (on-station trials)

Pasture	Stocking rate AU/ha	Liveweight gain g/day/animal
Native grass	1.8	227
	2.6	160
Brachiaria decumbens	1.8	503
	2.7	433

Source: IVITA (1989), and Santhirasegaram et al. (1975) cited by Riesco (1990).

Table 3. Pasture land use in Pucallpa, Peru

Pasture	Proportion of total, %	Frequency of farms where present, %
Brachiaria alone	44	80
Kudzu alone	12	28
Natural grasses	22	100
Kudzu associations	20	51
Total	100	100

Source: Riesco (1990).

Andean farming systems in Puno, Peru. IDRC, with the financial support of the Canadian International Development Agency (CIDA), is executing, jointly with the Instituto Nacional de Investigacion Agraria y Agroindustrial (INIAA), a research and development project to improve the well-being of peasants in five communities in the department of Puno. The department is in the Peruvian high plateau (Altiplano) bordering Bolivia and is the poorest in the country. Most of the communities are located at altitudes over 3,900 meters above sea level. The climatic pattern is erratic. Droughts, floods, hail, and frosts are common occurrences, making cropping rather risky except in the more protected areas surrounding Lake Titicaca where a more benign microclimate prevails. Livestock production is very important in most communities; cattle and minor species are raised in the lower altitude areas and sheep and South American camelids at higher altitudes. The project made a full characterization of the different communities, leading to an excellent understanding of the tremendously complex systems from the ecological, biological, economic, and social points of view. The project also conducted considerable research on components, especially in crops, pastures, and animal production. Simulation models were also designed and validated for alpaca, sheep, cattle and potatoes. Training and development activities were also conducted. A rotational seed fund was established with approximately 200 ha of seed nurseries of the main Andean crops and pastures.

One of the common practices in the communities surrounding the lake is the fattening of cattle, based on the grazing of Totora *(Scirpus totora)* and Llacchu *(Helodea potamogetum)*, which grow in the lake. This is done during the dry months (May-August). Farmers also harvest these forages from the lake and offer them fresh or spread on the ground; this causes losses of 20% to 40% (dry and wet season, respectively) due to trampling, urination, and defecation. The project determined, through the use of a simulation model and the climatic data of the last 50 years, that cattle heat losses due to the cold weather could reach up to 25% of the metabolizable energy consumed in the coldest months (May-August). Also observed was the fact that the high water content of the aquatic forages diminished consumption and therefore limited the cattle's performance in spite of their relative high quality. This led to the proposal of a cattle fattening scheme in which animals would be kept in rustic shelters and fed dried aquatic forages. Drying the forages for 48 hours could reduce their water content from 85-90% to 40%, while drying for four hours could result in a 70% reduction which could be appropriate for small quantities (R. Quiroz 1991, personal communication). *Ex-ante* analysis showed the practice to be feasible; a validation trial showed the considerable advantages of this fattening system (Table 4).

Table 4. Alternatives for cattle fattening based on Llacchu and Totora forage, in Carata, Puno, Peru

Alternative	Weight gain g/head/day
Housing + fresh forage	470
Housing + dry forage	1050
No housing + fresh forage	323

Source: INIAA (1991).

Institutional strengthening

Very few organizations have actually institutionalized the systems approach. However, considerable resources have been invested by the participating institutions in sustaining this approach, and the degree of commitment in many cases has been increasing. Another indirect indicator has been the additional funding and participation from other donors and institutions. Furthermore, IDRC has played an important role in supporting researchers for graduate training (Table 5); this could be tied to the impact that is being obtained through networking.

Table 5. IDRC's involvement in animal production systems training

Level of training

Region	Ph.D.	M.Sc.	Short courses[1]
Africa	5	7	8
Asia	--	2	60
Latin America	7	7	110

[1] in person-months

Source: IDRC files.

Network development

One of the outstanding characteristics of IDRC since its inception has been the promotion and support of research networks. IDRC participated in the development of the research network concept and the creation of many networks. The first one financed by IDRC was the Cropping Systems Network in Asia which was started in the mid-1970s, and which later became the ARFSN. The oldest network specifically addressing animal production systems research is RISPAL. IDRC also finances RIMISP in Latin America for the development of farming systems methodology. The African Feed Resources Network (AFRNET), based on two other networks that were supported by IDRC (PANESA and ARNAB), is coordinated by ILCA and supported by IDRC. The main emphasis of AFRNET is the development of adequate feeding systems for ruminants; however, a systems approach and a strong emphasis on on-farm testing is followed. In Asia, IDRC recently agreed to support the Small Ruminant Production Systems Network for Asia (SRUPNA). The number of countries and institutions involved, as well as the participating researchers is included in Table 6.

Table 6. IDRC-sponsored networks in animal production systems research, 1991

Network	Countries	Institutions	Researchers
Systems networks			
RISPAL (Latin America)	12	20	153
RIMISP (Latin America)	10	15	n/a
SRUPNA (Asia)	12	20	85
Systems-related networks			
RIEPT (Latin America)	18	51	104
ARNAB (Africa)	9	29	40
AFRNET (Africa)	10	23	25

Source: IDRC files.

ASSESSMENT OF IMPACT

Institutional

As mentioned, very few institutions have actually adopted systems research within their structures. The long and continuous operation of some systems projects, and the strong support provided by the oldest networks (i.e., RISPAL and ARFSN) have resulted, however, in a strong group of systems practitioners who are having an impact within their respective institutions and countries. In some cases, those researchers are playing a leading role within their institutional environment and have been able to successfully link research, training, and extension activities with a systems perspective.

International research systems

Stronger impact has been achieved in the case of international centers, which either have been coordinating networks for a long time or have had long-term support of specific research projects. In spite of some efforts to promote systems experiences in international forums and in professional associations, the impact at those levels has been limited. However, an increasing number of commodity researchers are more conscious of the need to evaluate commodities within a systems perspective, or at least to validate their results at the farm level.

Human resource development

Impact on human resources has been obtained through the training of staff associated with the projects. They have benefited not only from hands-on experience but in many cases from specific formal and in-service training organized by networks. As shown in Table 5, a large number of researchers have been trained in different parts of the world although the major impact has been achieved in Latin America and Asia, in great part due to the stronger and continuous support provided, and the role played, by networks.

CONSTRAINTS AND FACILITATING FACTORS

Institutional

Research organization and focus. It is a fact that most institutions are still organized along commodity lines and that the disciplinary focus prevails. This is a reflection of the type of training received by most professionals in both the developed and developing world. The choosing of the small farmer as a target population has resulted in a most difficult challenge for researchers and research managers, who have been formed along disciplinary lines, often with an orientation to different environmental conditions. The complexity of some of the problems to be solved requires not only a holistic understanding but a high analytical capacity. Often, institutions assign the younger and less trained researchers to conduct this type of research, while older, more specialized researchers are given managerial positions, conduct highly specialized research, or are reluctant to get involved in this kind of activity. However, in several of the projects supported by IDRC, this limitation has been removed, as strong teams have been assembled within the circumstances prevailing in the different countries.

Long-term research, staff stability, and donor fatigue. Animal production systems research, especially with animals of long reproductive cycle, is of a long-term nature. On the other hand, national institutions often become overly bureaucratized or politicized and researchers are not well rewarded, all of which leads to a high turnover rate of staff and directors, thus disturbing the research process. At the same time, overexpectations about the impact of FSR have been created, and the lack of greater and faster impact and the difficulties encountered are leading to a situation of donor fatigue. Other issues are appearing in the agendas of donor agencies, making support to systems projects increasingly more difficult.

Research and development linkages

In most developing countries, the linkages between research and development efforts are weak. In a very few cases, development projects are formulated from the results of research activities, as the pressures for change are high. On the other hand, experiences from development

projects are seldom utilized, and valuable feedback opportunities are lost. The need for impact and the scarcity of available resources demand a more efficient linkage between research and development.

Methodology

The extrapolation of cropping systems methodology to tackle animal production or mixed systems research has not been possible in the case of small farms. Difficulties associated with sample size, random sampling, animal mobility, number of experimental units, statistical design, variability of experimental units, and others have been encountered. Therefore, on many occasions case studies have had to be used. Simulation has also helped to screen possible alternatives, and creativity has helped in finding new technologies. One has to recognize that the methodology is still evolving; therefore, new projects should benefit from the experience gained by older projects.

Human resources

There is a scarcity of trained technical staff in many institutions in the developing world. Formal training in FSR is rather limited, which is a clear constraint for the implementation of many systems projects.

OUTLOOK

Expansion of systems research

Given the emergence of new development concerns, systems researchers will have to face new challenges. The implications of this need to be discussed widely and practical experiences need to be developed. Since it would be impractical to form very complete technical teams to encompass all the necessary disciplines within a single institution, complementary efforts may have to be sought among key institutions. Rather than developing a large number of projects working on the same issues, most probably resources will need to be concentrated on fewer, but more solid research undertakings, involving highly experienced personnel with high analytical capacity. The mistakes made in earlier systems projects, by perceiving an oversimplified set of problems calling for

simplistic solutions, need to be avoided. Moreover, new issues (such as impact on environment and sustainability, gender, and equity) need to be analyzed in a systematic, serious way, and openly discussed with donors and international organizations.

Given a situation of constrained resources, research will need to be carefully prioritized. In this respect, the study of whole-commodity systems, in order to understand the relation between environment, production, processing, marketing, and utilization, as well as to identify bottlenecks and impact opportunities, may help in the prioritization process.

From research to development

The linkages between research and development must be strengthened. A common understanding of the goals, procedures, and roles of the different actors needs to be reached. There is a tendency in some institutions to think that because of the relatively limited impact of micro-level research, this should be deleted in order to concentrate on macro-issues. The temptation to pursue policy issues exclusively, as well as to look for rapid, simplistic solutions, is great. The danger of that route is that badly formulated policies could cause serious damage and the time required for recovery may significantly delay the development process. The value of micro-level research and its use to formulate policies need to be recognized. At the same time, the impact of macro-policies on the rural situation needs to be determined.

The role of the private sector

Given the constraints faced by most governmental institutions in the developing world, the need to streamline and improve institutions is leading to a reevaluation of the role of the private sector in all aspects (i.e., research, extension, promotion). In the case of Latin America, there is a proliferation of nongovernmental organizations, which are competing with governmental institutions and universities for research and development funds. Their objectives and modes of operation vary considerably; therefore, impact assessment must be based on a careful analysis of the role of the different institutions, and their comparative advantages need to be weighed so as to avoid a dilution effect in the use of resources. One alternative that could be followed is the channeling of governmental efforts to the less-affluent sectors of society, while the private sector could finance

and conduct its own research. This, of course, is not the only alternative; what to recommend depends on the situation of the different countries and the objectives of the different institutions.

The approach to international cooperation

Resources are becoming more scarce, and competition for them tougher. Also, competition among donors sometimes hampers development efforts, since human resources are scarce and agendas are often conflicting. International cooperation should be based on mutual understanding of the needs, aspirations, and possibilities of developing and developed countries. Coordination among donors may be needed to avoid duplications and misuse of resources.

The development of human resources

There is a continuous need to form more and better professionals and practitioners in developing countries. It must be recognized that the orientation provided in developed countries is not necessarily the most suitable for the conditions in developing countries. A more careful analysis of the needs of, and the type of training required by, developing countries needs to be made. The development of analytical capacity should be stressed in the formation of professionals.

IDRC's experiences while supporting systems research in developing countries have been fruitful. They have permitted: (1) a better understanding of the great variability of situations encountered in the different countries and the difficulties often faced by local researchers, (2) an understanding of the long-term nature of the process, and (3) the recognition of the progress achieved through a "learning by doing" process. Solutions are not always simple; however, it is in the hands of the people directly involved to work toward meeting their own aspirations. IDRC has learned to recognize its supporting role in the achievement of those objectives.

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